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10/541,611	07/07/2005	Satoshi Yamanaka	1190-0756PUS1	8340

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EXAMINER	
ZHU, RICHARD Z	

ART UNIT	PAPER NUMBER
2625	

NOTIFICATION DATE	DELIVERY MODE
03/10/2011	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

mailroom@bskb.com

Office Action Summary	Application No.	Applicant(s)	
	10/541,611	YAMANAKA ET AL.	
	Examiner	**Art Unit**	
	RICHARD Z. ZHU	2625	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 February 2011*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-7* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-7* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 02/09/2011 has been entered.

Status of the Claims

2. Claims 1-7 are pending.

Response to Applicant's Arguments

3. **In response to "**Moreover, because an interpolation method is performed on each block each pixel does not receive the same interpolation. As is seen by the illustration of (a), (b), (c), and (d) while a specific pixel in a block is interpolated in one technique, a second technique may require use of different pixels within that block and not that same pixel interpolated in the first technique. Thus, while a comparison is thus made of the original signal with an interpolated signal this is not necessarily accomplished for the same pixel within the block under each of the interpolation methods performed by Ashibe**"**.

Looking at applicant's disclosure with respect to Figs 3 and 9, the general idea behind the instant invention consist of finding out the best interpolation method for each of the lost pixels by taking its surrounding normal pixels, assume they are lost, apply various interpolation techniques to generate interpolated values of the normal pixels, compare the interpolated values with normal pixels' original value, pick the interpolation technique with the smallest difference between the interpolated value and the original value, and apply that technique to interpolate the lost pixels.

- **Ashibe discloses substantially the same interpolation selection process in order to find an interpolation technique with the least interpolation error.**

As noted in prior office actions, **Ashibe** take blocks of normal pixels, assume they are lost, apply various interpolation techniques to generate interpolated values of the normal pixels, compare the interpolated values with normal pixels' original value, pick the interpolation technique with the smallest difference between the interpolated value and the original value, and apply that technique for interpolation (**Pages 8-9 of Ashibe**).

Thus, **Ashibe** teaches a general method of selecting the best interpolation technique given a plurality of interpolation techniques.

- **Zhang discloses a solution for selecting the best interpolation technique out of a plurality of interpolation techniques to interpolate an unknown / lost pixel.**

As noted in previous office actions, **Zhang** assumes that a frame may contain one or more lost / unknown pixels for which no image information is available (**Col 1, Rows 50-55**). To solve this problem, for each unknown pixel, **Zhang** isolated the unknown pixels and its surrounding pixels in a block of size 3 pixels by 3 pixels (**Fig 2**), apply various

interpolation techniques (**Zhang does disclose a plurality of interpolation technique in at least Fig 2 and Col 5, Rows 50-55. Each interpolation technique concerns interpolation in a different direction (i.e., local edge) where Fig 2 showed more than one interpolation direction and therefore technique**) in a test run to thereafter select the best interpolation technique with the so called "least harmful" local edge (**Col 6, Rows 33-36 and Equation 6**) for each unknown / lost pixel.

Therefore, **Zhang** and **Ashibe** are both concern with selecting the best interpolation technique out of a plurality of interpolation techniques available.

- **One of ordinary skill in the art at the time of the invention would've been motivated to apply the interpolation selection technique of Ashibe to solve the problem of Zhang and the resulting application would have yielded the same invention.**

One of ordinary skill in the art, looking at the alternative solution provided by **Ashibe** to achieve the same purpose of using the best interpolation technique out of a plurality of interpolation technique, would have reasonably and alternatively applied **Ashibe**'s technique in place of its "least harmful" method. Specifically, the alternative provides a predictable solution to a problem that one of ordinary skill in the art is concerned with. The resulting modification is as follows:

Instead of applying **Zhang**'s "least harmful" selection strategy, **Zhang** would identify and isolate each unknown / lost pixel within a frame to make it the center of a plurality of 3 pixels by 3 pixels blocks. Thereafter, apply the technique of **Ashibe** for each block, which individually corresponds to an unknown or lost pixels detected in a frame. In particular,

Zhang would apply a plurality of interpolation techniques (**Fig 3 of Ashibe**) to the block with the lost pixel in the center by assuming the surrounding normal pixels around the lost pixel are lost, interpolate the normal pixels to generate corresponding interpolated values, compare the interpolated values corresponding to each technique with the normal pixels' original values, calculate the absolute value differences between the original values of the normal pixels and the interpolated values of each interpolation technique for that block to determine the interpolation technique with the least absolute value difference (**in accordance to Ashibe**). The resulting interpolation technique would be applied to interpolate the lost pixel within that block.

In this manner, the modification would've predictably performed this method for each lost pixel within a frame of image with one or more lost pixels.

In conclusion, while **Ashibe**'s method to find the best interpolation technique does not correspond to any specific lost / unknown pixels, the application of **Ashibe**'s method for each block of predetermined size to solve **Zhang**'s problem would predictable result in the selection of the best interpolation technique for a specific lost / unknown pixel that is the center of a 3 pixel by 3 pixel block.

Claim Objection

4. Claim 1 is objected to. Specifically, "unkown" should read "unknown".

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1-6 are rejected under 35 USC 103(a) as being unpatentable over **Ashibe et al. (JP 363122385 A)** in view of **Zhang et al. (US 7136541 B2)** and **Jiang (US 7242819 B2)**.

Regarding the apparatus of Claim 1 and therefore method of Claim 4, Ashibe discloses a pixel interpolation circuit (**Drawing 2, Unit 20**) for generating interpolation pixel data which interpolates an input image based on pixel data composing the input image (**See Abstract**), the pixel interpolation circuit comprising:

an interpolation unit (**Drawing 2, Unit 20**) for calculating interpolation data using (1) a plurality of different interpolation methods (**Fig 3**) on each block for a plurality of blocks of normal pixels constituting the input image and (2) test interpolation data of a plurality of normal pixels constituting the block (**Page 8, Paragraph 4, "when an image signal is first input on the transmission side, thinning and interpolation for each mode are performed" and Page 6, "a case is considered in which an image is divided into blocks having a predetermined size"**), wherein said test interpolation data is calculated for each of said normal pixels on the assumption that said normal pixels is lost (**Page 8, paragraphs 2-4 and see Page 10. Before actual thinning for transmission to a reception side, test thinning is performed using different thinning ratio and different interpolation methods corresponding to different thinning ratio are used to calculate interpolated**

signal for each normal pixel within a block because some normal pixels are assumed to be lost during the thinning process. See Drawing 3, pixel "o" and pixel "x" are normal pixels where "x" are assumed to be lost);

a determining circuit (**Drawing 2, Unit 20**) for selecting one of the interpolation methods which most accurately reflects the pixel values of the normal pixels based on a difference between the test interpolation data and actual pixel data of said plurality of normal pixels for each block (**Page 8, Paragraph 5, selecting a mode of thinning and corresponding interpolation method that generates the least distortion amount, the distortion amount being the absolute value of the discrepancies between interpolated signal and the original signal**).

Ashibe does not disclose using different interpolation methods to independently calculate interpolation candidate data of the same unknown interpolation pixel for each unknown interpolation pixel and when an optimal interpolation method is chosen, using an output circuit to output interpolation candidate data calculated using the optimal interpolation method.

Zhang, in the field of selecting an optimal interpolation method to generate interpolation candidate data of an unknown interpolation pixel at a center of a block of three pixels by three pixels (**Col 6, Rows 15-33, calculating interpolation candidate data base on various interpolation methods**), discloses an interpolation circuit that uses a plurality of different interpolation methods to calculate interpolation candidate data of an unknown interpolation pixel (**Col 5, Rows 18-32 and Col 6, Rows 18-32**) for each unknown interpolation pixel in a block of pixels (**Col 5, Rows 36-49**); the unknown interpolation pixel

being considered as a pixel for which image characterization information is missing or in error that is surrounded by a plurality of normal pixels constituting the block (**Col 1, Rows 50-60 in view of Fig 2**).

a determining unit for selecting an interpolation method (**Col 7, Rows 1-25, in particular, Col 7, Rows 15-20**);

an output circuit for outputting the interpolation candidate data calculated by the selected interpolation circuit as the interpolation pixel data for the unknown interpolation pixel (**Col 7, Rows 19-20, once the least harmful edge is determined, then a value for pixel "x" may be generated by interpolation**).

One of ordinary skill in the art, looking at the alternative solution provided by **Ashibe** to achieve the same purpose of using the best interpolation technique out of a plurality of interpolation technique, would have reasonably and alternatively applied **Ashibe**'s technique in place of its "least harmful" method. Specifically, the alternative provides a predictable solution to a problem that one of ordinary skill in the art is concerned with. The resulting modification is as follows:

Instead of applying **Zhang**'s "least harmful" selection strategy, **Zhang** would identify and isolate each unknown / lost pixel within a frame to make it the center of a plurality of 3 pixels by 3 pixels blocks. Thereafter, apply the technique of **Ashibe** for each block, which individually corresponds to an unknown or lost pixels detected in a frame. In particular, **Zhang** would apply a plurality of interpolation techniques (**Fig 3 of Ashibe**) to the block with the lost pixel in the center by assuming the surrounding normal pixels around the lost pixel are lost, interpolate the normal pixels to generate corresponding interpolated values, compare

the interpolated values corresponding to each technique with the normal pixels' original values, calculate the absolute value differences between the original values of the normal pixels and the interpolated values of each interpolation technique for that block to determine the interpolation technique with the least absolute value difference (**in accordance to Ashibe**). The resulting interpolation technique would be applied to interpolate the lost pixel within that block.

In this manner, the modification would've predictably performed this method for each lost pixel within a frame of image with one or more lost pixels.

While the interpolation unit of **Ashibe** independently calculates interpolation candidate data of the same interpolation pixel using respective different interpolation methods, **Ashibe** does not disclose the internal structure of said unit comprise a plurality of independent interpolation circuits.

Jiang discloses an interpolation circuitry configuration that takes edge direction into consideration when performing interpolation (**See Figs 1-2**) having an internal structure comprising a plurality of interpolation circuits with specific logic components each independently calculates interpolation candidate data (**Fig 8, Adder Logic 88 and Division Logic 90**) of a same pixel to be interpolated (**Fig 1, Pixel to be interpolated**), using different interpolation methods (**Col 13, Rows 48-58**).

Jiang demonstrated that it is well known in the art to implement separate sets of logic to form independent circuits to each perform its respective interpolation methods, it would've been obvious to one of ordinary skill in the art at the time of the invention to design the internal circuitry of interpolation unit of **Zhang** with independent circuits to calculate

respective correlation values of respective different interpolation methods such that its intended function as disclosed would be successfully implemented. As a result, the application of **Ashibe**'s teaching to solve the problem of **Zhang** would calculate test interpolation data for each of the normal pixels within a block of normal pixels for each of the plurality of interpolation circuits on the assumption that said normal pixels are lost.

Regarding Claims 2 and 5, Ashibe, which is to be applied to solve the problem of **Zhang**, discloses wherein the determining circuit calculates a evaluation data for each of the interpolation circuits, by summing up the absolute values of the difference between the test interpolation data and the actual pixel data, and selects one of the interpolation circuits based on the evaluation data (**Abstract, "Then, <u>the sum in the block of the absolute value of the difference</u> between an interpolation signal and an original signal, namely, the quantity of the distortion to the respective modes for every block is calculates the <u>decide the mode to all the blocks based thereon</u>"**).

Regarding Claims 3 and 6, Ashibe, which is to be applied to solve the problem of **Zhang**, discloses wherein the determining circuit calculates binarized or ternarized values of the difference between the test interpolation data and the actual pixel data (**Drawing 3 (c), at least two or more sets of neighboring "o" are used to calculate a specific "x"**).

7. Claim 7 is rejected under 35 USC 103(a) as being unpatentable over the combination of **Ashibe et al. (JP 363122385 A), Zhang et al. (US 7136541 B2)**, and **Jiang (US 7242819 B2)** in view of **Saver (US 5418714 A)**.

Regarding Claim 7, the combination does not disclose that the pixel interpolation circuit is within an image scanner.

Saver discloses such configuration (**Fig 1A, Corneal Image System with a CCD camera module 110**).

Therefore, one possible implementation of the combination would be a scanner system the likes of **Saver** where image data is compressed and store into a memory. When the user require the image be outputted by an output unit (**for example, display or printer**), it is interpolated by a scanner processor (**Col 9, Rows 10-12**). In this way, memory storage is conserved and an apparatus or circuit as required by the claims is obtained.

Conclusion

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to examiner Richard Z. Zhu whose telephone number is 571-270-1587 or examiner's supervisor Chan Park whose telephone number is 571-272-7409. Examiner Richard Zhu can normally be reached on Monday through Thursday, 6:30 - 5:00.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Richard Z. Zhu/
Patent Examiner
Art Unit 2625
03/04/2011